observed. The relation of the horizontal axes is 0.467:1. The axial plane is the base, with the *a* axis the negative bisectrix. The pleochroism is strong, $\mathfrak{a} + \mathfrak{b}$ yellowish-gray, $\mathfrak{c}$ = grayish-white. $\mathfrak{a} > \mathfrak{b} > \mathfrak{c}$. The analysis of Knebelite would indicate that it is a manganese olivine, with most of the optical properties of this mineral.

BOTANY.[1]

VARIATIONS OF TRADESCANTIA VIRGINICA.—An interesting case of floral variation is under observation by the writer in the shape of a highly aberrant form of *Tradescantia virginica*, or spiderwort, also called, in quaint allusion to the ephemeral nature of its petals, "widow's tears." Said plant presents, as the result of thirteen years' cultivation, the curious aspect of a monocotyledonous plant having in bloom, at the same time, flowers of dimerous, trimerous, tetramerous, pentamerous, hexamerous and heptamerous types respectively, each flower having twice as many stamens as sepals, petals or carpels of ovary. The plant was set out in 1872 and received very rich treatment, so that it gave forth blossoms measuring two inches in diameter. In 1874 it began to deviate from the original trimerous type and to assume the tetramerous one, by developing another petal, and instead of doing this at the expense of the pistil or stamens, it *added* another sepal, another carpel with style, and two stamens, thus making a typical tetramerous flower. The plant has since then continued to differentiate in a greater degree each succeeding year, the differentiated forms being typical plants and maturing seed capable of perpetuating and possibly increasing the differentiation. The seed of differentiated forms gives plants having a large number of aberrant forms, while that of normal flowers gives a few abnormal forms, showing that the plant is working out a plan of evolution. The original trimerous plant was set out in 1872; in 1874 the tetramerous plant was evolved; in 1876 the pentamerous; in 1879 the hexamerous; in 1882 the dimerous; and in 1884 the heptamerous. Of these differentiated forms, as observed last year, the most plentiful were the *pentamerous* flowers, giving a complete refutation to the dictum, "Endogens *never* have the parts of the flowers in *fives*."

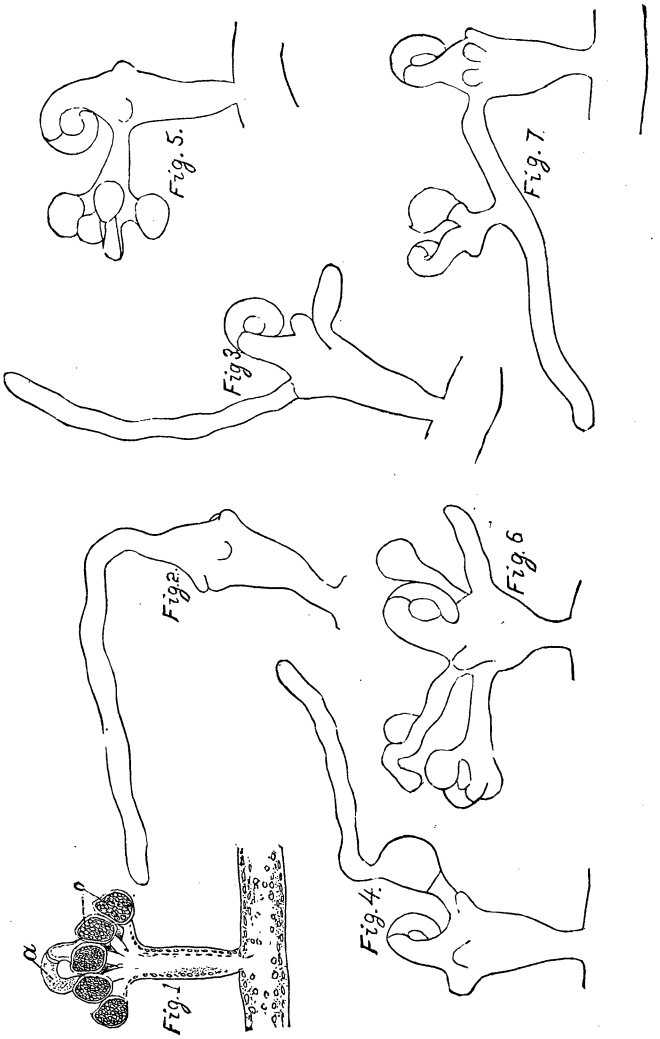
The dimerous and heptamerous types are as yet but few, as they are struggling for existence. The hexamerous and heptamerous flowers occasionally show an imperfect carpel, and in one case a heptamerous flower had an octamerous ovary with two imperfect carpels, showing that seven is evidently not the limit of differentiation. A number of interesting experiments have been made regarding the intensity of variation, showing that it is very pronounced.

Roots of this plant and seeds from trimerous, tetramerous,

[1] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

hexamerous and pentamerous forms have been sent to Dr. Asa Gray for cultivation, at his request.—*G. A. Brennan, Roseland, Ill.*

SOME ABNORMAL FORMS OF VAUCHERIA.—While engaged in the study of Vaucheria with my classes in botany, some weeks since, my attention was called to some very curious abnormal develop-



Abnormal forms of Vaucheria.

ments that seemed to me worthy of record. The commonest species of Vaucheria in the neighborhood of Detroit is *V. geminata* Vauch, var. *racemosa*, and it was in this species that the abnormal growths referred to were observed.

The ordinary form of the fertile part of the plant is shown in Fig. 1. The sexual organs arise as buds upon a common branch, the single antheridium being terminal and decidedly curved; the oögonia varying in number from two in the typical form of the species to eight or nine in some specimens of the variety. They are arranged in a circle about the base of the antheridium (Fig. 1, *o*).

The specimens when first collected showed no peculiarities, but after being kept for a week or two in rather confined quarters, a large proportion of the fertile branches developed abnormally, owing no doubt to the unnatural conditions in which the plants were grown.

The accompanying figures will show the more peculiar cases observed. In all of these it will be seen that the branches that under ordinary circumstances would develop into the sexual organs are here variously modified.

In Fig. 2 the antheridium is replaced by a filament that is in all respects like an ordinary vegetative filament.

In Fig. 3 the antheridium is perfect, but the oögonia are replaced by slender filaments.

In Fig. 4 one oögonium has developed, but its apex is prolonged into a filament like those in Fig. 3.

In Fig. 5 the antheridium is complete, but one of the lateral buds has developed a secondary branch bearing a complete set of sexual organs, a perfect antheridium and four perfect oögonia.

Fig. 6 shows a case where in addition to the ordinary antheridium two others are developed with accompanying oögonia from the lateral buds.

In Fig. 7 one of the lateral buds has grown out into a filament which bears laterally a smaller branch upon which a perfect antheridium and oögonium and a rudiment of a second oögonium were formed.—*Douglas H. Campbell, Detroit, April, 1886.*

BOTANY IN WINTER.—In connection with the subject of "Teaching botany in winter," treated recently, though briefly, in the AMERICAN NATURALIST, I would like to say a few words. My sophomore class of over fifty members begins its second term in botany the last week in February. The college vacation is during December, January and most of February. The sophomore class has had one term of botany as freshmen in the previous autumn. The class meets twice each week in both the freshmen and sophomore years, and a field exercise is required between each meeting. During the autumn the class study first leaves, next flowers and later in the season fruits. Any botanist will at once note the special facilities for the study of fruits. The class comes to the sophomore work in February, having had very little concerning stems and buds. The first field exercise for this year was the making of a careful drawing of at least three inches of

the tip of an elm and of a maple branch. The students were given no further instruction. They are never told what to look for. From my pile of sketches and descriptions I quote the whole of the first one without making any selection :

" 1. Drawing of maple branch with terminal and opposite lateral buds. Stem thick and of a red color, covered with small specks. Wood not so tough as elm. Buds more tender. 2. Drawing of elm twig with a terminal bud and alternate lateral buds. Wood compact and tough. Buds appear to be better protected from weather than maple." The drawing, if not the description, would indicate that the maple is *Acer dasycarpum.*

For the next field work each member of the class was requested to make a study of the last year's growth of a branch of each of two kinds of Acer. What is Acer? was one of the first questions each member answered for himself. This lesson brought out the specific peculiarities of members of the same genus—peculiarities not easily found in books within the reach of students. One of the first duties of a teacher in natural science is to keep students away from printed descriptions. They must go to the objects and make their own descriptions. I quote again from the first paper :

" The bark of No. 1 is of a lightish color and it is difficult to tell a year's growth, while that of No. 2 is of a red color and it is very easy to recognize a year's growth, as there is a marked difference in the color. The coverings of the buds of No. 1 are much more scaly than those of No. 2, and they are also more closely attached to their buds than those of No. 2 are attached to their buds. The internodes of the first are much shorter than those of the second. The year's growth of the first is shorter than that of the second, as it grows more slowly."

Much better work than this is found on several papers. The " chance selection " is not far below the average. The following questions were given the class at its next meeting and written answers handed in: (1) Have you observed any branching on the last year's growth? (2) What are the differences in the buds of the two maples? (3) Give number of buds on year's growth of each. (4) Relative size, flexibility and strength of the two kinds of twigs. (5) Where are the flower-buds? The fourth question opened the eyes to many important subjects, and the fifth set them in search of the promises of blossoms on the twigs. At this meeting two microscopes were so placed that each student of the large class could look in as he filed out of the lecture-room at the close of the exercise. Under the first instrument was shown a longitudinal section of a fresh leaf-bud, and under the second a like view of a flower-bud, both of the lilac. It may be stated here, in passing, that each member of the class gets either one or two microscopic views in the above way at each meeting.

Without here fully following out the course, it may be said that

after the buds and branches had been canvassed we took up the evergreens, and as a first lesson each student made a drawing of a branch of any pine and any spruce he might choose. This was followed by a study of two species of Pinus, which brought out the characteristics that pertain principally to branches and their leaves. The study of the evergreens being disposed of, in of course only a general way, the class took as a single field exercise the following: Make a study of a branch bearing thorns and of another bearing prickles.

It would be a pleasure to reproduce here the descriptions on a dozen papers, but already these notes are far longer than they were expected to be at the outset. Here is one, however:

"No. 1 has large spines or thorns situated just above the lateral buds. These thorns are branched, having small thorns very much like the original one, only smaller. One of these thorns has two small ones upon it situated nearly opposite each other. No. 2 has many prickles, with three on each internode. They appear to have a definite arrangement with respect to each bud, one being situated a little to the left of and below the bud, another is a little farther down on the stem and to the right; the third is much farther down and directly under the bud. The prickles are quite large at the base, but easily broken off from the bark. Many of them have fallen off. Prickles grow on the bark and have no union with the wood, and come off on the bark when the branch is peeled. The thorns are connected with the woody structure."

To-day (March 28th) the class brought in their work upon the study of pith. The directions given were as follows: Study the stem of a plant with a large pith and one with a small pith. The two stems are to be of the same diameter. Make a cross-section of each stem and draw them four times enlarged, showing all the parts. Make radial section lengthwise and draw as for cross-section.

Each student collects his own material. A specimen paper, of course without the drawings, is submitted:

"The linden (No. 1) has a small pith about $\frac{1}{32}$ inch in diameter, situated at or near the center. The relative thickness of wood to pith, in No. 1, is about one to seventeen, and in No. 2 (elder) it is about three to five. The distance from the surface of the bark to the pith, in No. 1, is about $\frac{5}{16}$ inch, the stem being a little more than $\frac{5}{8}$ inch in diameter. In No. 2 the distance from the surface of the bark to the pith is nearly $\frac{3}{16}$ inch, the diameter being about the same as that of No. 2. The pith in the latter is not so firm as that of No. 1, and seems to be made up of larger cells. The middle layer of bark in No. 1 is of a greenish color, that of No. 2 has brown spots which seem to alternate with spots of white. These spots are mostly triangular in form, with the base next to the wood."

Work of the nature above pointed out will be continued until

the spring flowers come, when each student is prepared to make an herbarium of plants collected and determined by himself. It is doubtless true that the work in the fall term helps in the field work herein mentioned, but there is no question that students with no knowledge of plants can take hold of botany in the winter and do excellent, interesting work—work that is at the foundation of morphology and gross anatomy, the fresh material for which is in better condition than during the growing season when buds are forming and branches and leaves obscure the view.—*Byron D. Halsted.*

ENTOMOLOGY.

A CARNIVOROUS BUTTERFLY LARVA—PLANT-LICE FEEDING HABIT OF FENESICA TARQUINIUS.[1]—One of the most interesting of our butterflies is that known as *Fenesica tarquinius*, a unique Lycænid having the wings above brown-black in color with conspicuous orange markings both on primaries and secondaries. It has a wide geographical range, occurring very generally over North America as also in Asia.

Donovan, in his "Insects of India" (Pl. XLIV, fig. 1), illustrates the butterfly rather poorly, but says nothing about the larva.

Boisduval and LeConte (Hist. des Lép. et des Chen. de l'Am. Sept., p. 128, Pl. XXXVII) figure the larva, pupa and imago under the name of *Polyommatus cratægi*, and simply quote Abbot as stating that the larva lives on several species of Cratægus.

Scudder (Proc. Essex Inst., Vol. III, p. 163, 1862) treats of it under the name of *Polyommatus porsenna* (Syn. List of Am. Rurales, Bull. Buff. Soc. Nat. Hist., III, p. 129, May, 1876) and gives the food-plants of the larva as Alnus, Ribesia, Vaccinium and Viburnum. Later, in the AMERICAN NATURALIST for August, 1869, he gives the food-plants as follows: "Probably arrow-wood, elder and hawthorn."

Grote (Trans. Am. Ent. Soc., II, p. 307) first proposed the generic name of Fenesica, but says nothing about its larval history.

Strecker (Butt. and Moths, etc., Diurnes, p. 103) repeats simply from Scudder; while Wm. H. Edwards, in his admirable life-histories of butterflies, has not so far treated of this particular species. In short, so far as the published records go, it has been generally assumed that the larva feeds upon the plants named.

The object of this brief communication is to show that in this larva we have one that is truly carnivorous, a fact which is extremely interesting because, so far as I can find, there is not another recorded carnivorous butterfly larva; and Mr. Scudder, who has given great attention to the butterflies, writes me in a recent letter, in reply to an inquiry on this point, that he cannot recall any mention of such. Quite a number of Heterocerous larvæ

[1] Abstract of a paper by C. V. Riley, read Feb. 20, 1886, before the Biological Society of Washington.